SUTTER INSTRUMENT COMPANY

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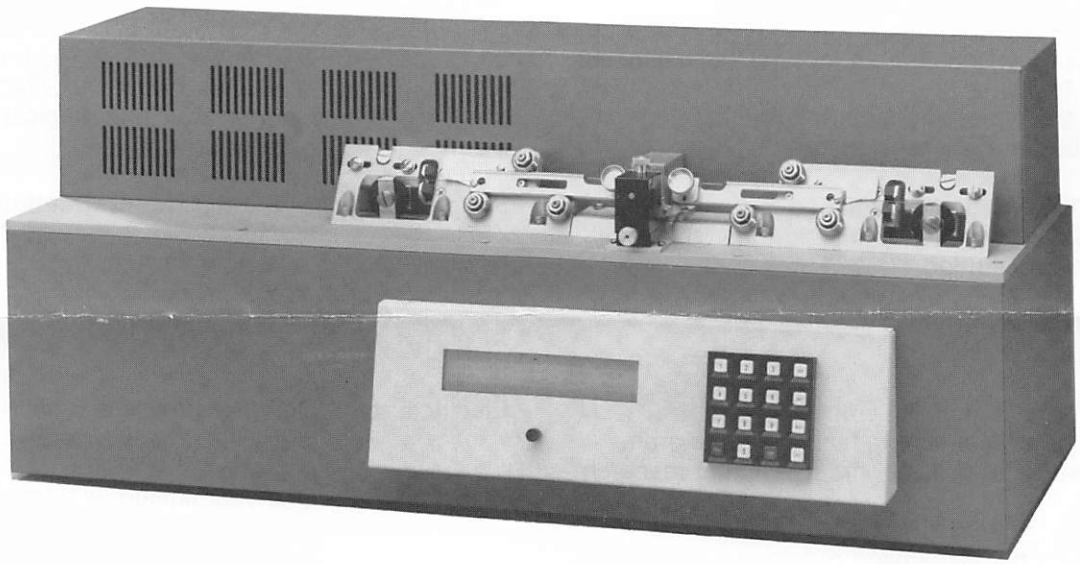
MODEL P-2000 QUARTZ MICROPIPETTE PULLER



The laser based, quartz micropipette puller Model P-2000* is the result of an extensive Research & Development effort by Sutter Instrument Company. Utilizing the proven mechanical system of the Flaming/Brown Type Puller Model P-87 in combination with a powerful CO_2 laser and a sophisticated, programmable microprocessor controller, the P-2000 represents a significant advance in the technology of micropipette fabrication.

Quartz and synthetically produced fused silica are exceptionally pure silicon dioxide materials possessing superior qualities for electrophysiological research. (For purposes of this discussion, the terms quartz and fused silica will be used interchangeably.) Prior use of quartz has been limited because its melting point exceeds that of conventional metal filaments. With the advent of the P-2000, investigators may now take advantage of the superior mechanical strength and ultra-fine tip formation capabilities of quartz not achievable with other glass formulations. Using quartz, Sutter Instrument Company has pulled electrodes with tip diameters less than 0.01 microns.

Preliminary reports indicate that quartz pipettes can penetrate tough tissues that would normally break conventional pipettes and that quartz pipettes are reusable.[1] Thin-wall quartz can form tips that can penetrate cells as well as thick-wall borosilicate yet the thin-wall quartz will have a larger pore size and therefore lower resistance.

Quartz exhibits superior electrical characteristics demonstrated by a low dielectric constant, a low loss factor and a volume resistivity that is orders of magnitude greater than borosilicate. Based on the above properties, quartz should have superior noise performance when compared to pipettes made from any other glass. With the exception of quartz, all common glasses incorporate metal ions to decrease their melting point. By eliminating these metal ions recording artifacts and alteration of channel kinetics may be minimized.[2]

Optically, quartz is virtually free from fluorescence when illuminated.

Several factors led to the selection of a laser as the heat source for quartz pipette fabrication. Laser heat is clean; it does not leave an evaporative metal residue on the pipette as do conventional filaments. The end user can program the amount of heat (power) to be supplied to the glass, and define the pattern of heat distribution along the glass. The laser leaves no residual filament heat; when the laser is turned off heat delivery to the glass stops instantly eliminating the need for an air jet cooling system.

*U.S. Patent #'s: 4,921,522; 4,913,719; 4,869,745. International patents pending.

The P-2000 can store up to 64 separate programs, with each program consisting of up to 16 command lines. Programmable parameters include Heat, Pull Strength, Velocity (criteria for trip point), Filament type, and Delay time between the trip point and the hard pull.

The P-2000 contains a 'ramp test' which initiates a 'self-test' to insure proper function and facilitates filament adjustment by reporting recommended Heat value for the glass/filament combination.

The P-2000 has been developed for use with 1.0mm O.D. tubing and at this time no other O.D. size is recommended.

Features

Ease of programmability combined with the freedom of programmable filaments allows one instrument to be used for many different research projects.

The laser is not self limited due to a melting point as with conventional metal filaments, and therefore cannot be 'burnt out.'

Pulls electrodes with tip diameters less than 0.03 microns.

Measures velocity of the system as the glass softens and begins to pull apart under a constant load. The increasing velocity of the initial pull is determined by the viscosity of the glass, which in turn is a function of the glass temperature. The adjustable velocity allows for selection of a precise glass temperature as the trip point for the hard pull. (Patent No. 4,600,424)

The laser is completely contained ensuring operator safety.

Operating life of the CO_2 laser is expected to be in excess of 5 years with normal use, after which the laser can be refurbished by the Sutter Instrument Company for a nominal charge.

Though the P-2000 was designed specifically for quartz tubing it can easily handle both borosilicate and aluminosilicate glasses.

References

1. Munoz, J.L. and J. Coles. Quartz micropipettes for intracellular voltage microelectrodes and ion selective microelectrodes. J. of Neuroscience Methods. 22:57-64, 1987

2. Zuazaga, C., and A. Steinacker. Patch-clamp recording of ion channels: Interfering effects of patch pipette glass. News in Physiological Science. 5:155-159, 1990

Specifications and Ordering Information

Quartz tubing is available through Sutter Instrument Company.

Size & Weight: 37" x 19" x 19"

Electrical:	Operates on 115/230 Volts, 50/60 Hertz power line.
Warranty:	One year limited warranty, parts and labor. Repairs or modifications without factory authorization, misuse or abuse will void warranty.
F.O.B.	Novato, CA
Terms:	Net 30

Quality Control

Sutter Instrument Company, as a leader in the production of high quality micropipette pullers, takes great pride in the quality of its products. We maintain a complete SEM facility in house to check the performance of each micropipette puller before it is shipped. In the case of the Model P-2000, each puller is tested by pulling a group of pipettes which are then examined with the SEM. All the pipette tips must measure less than 0.05u (typical result—0.03u) before the puller is approved for shipment. Included with each P-2000 is a photograph of one of the electrodes pulled on that puller. This level of quality control is offered by no other manufacturer of micropipette pullers.

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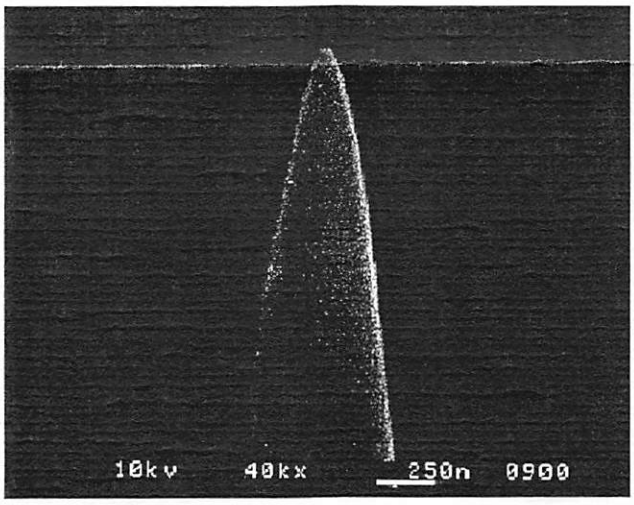
Dear Scientist,

At the recent Near Field Optics meeting in North Carolina we showed our ***P2000*** puller. Since it is a CO_2 laser-based puller it is capable of pulling quartz fibers. Ours is a ***complete turn-key system*** with integrated laser that has been servo stabilized to an accuracy of ± 1%.



Typical fiber tip made with the P2000. We generate similar photomicrographs of tips pulled by each instrument before shipment.

Sutter Instruments has manufactured pullers for almost 20 years and we have now dedicated a large portion of our R&D resources to Near Field Optics.

The enclosed sheet outlines the properties of the ***P2000.*** Please look it over carefully and call us to discuss your application.
We think that we have the right tool for your research. A short discussion with our technical staff should help you in deciding this for yourself.

Best Regards

Dale L Flaming

Dale Flaming
President

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